LITTLE BLUE BOOK NO. 136
Edited by E. Haldeman-Julius

Measles, Diphtheria, Scarlet Fever, Chicken Pox and Whooping Cough

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PREFACE

It is generally recognized that the prevalence of contagious diseases, and their associated injury to life and health, especially of children, can only be satisfactorily limited if the full co-operation of those who have the care of children is secured. This is dependent almost entirely on general information. Scarcely any parent will willfully endanger the health of the children of others. It is hoped that this brief statement of facts, on which authorities agree, may be of some use to those who are responsible for the health of children. It is not intended to encourage the treatment of sick children without trained advice, but rather to aid in securing intelligent aid to the doctor and public health officer.

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MEASLES, DIPHTHERIA, SCARLET FEVER, CHICKEN POX and WHOOPING COUGH

GENERAL CONSIDERATION

Before beginning the consideration of the individual diseases enumerated in the title, a review of some of the things which relate to them in common may prevent subsequent repetition. The importance of this group of diseases is realized when one remembers that during the ten years ending in 1922, in a large city such as Chicago, more than one person out of every seven of the population suffered from one of these diseases and one out of every 150 died from one of them. Combined these diseases cause about one-fourth of the deaths among children from one to ten years of age. Not only are they responsible for abundant deaths, but they also leave in those that recover a legacy of permanent damage in the heart, lungs, ears, eyes and other parts of the body. Statistics show that more than one-fifth of the cases of deaf-mutism follow scarlet fever, measles and diphtheria. Chronic diseases of the heart and of the kidneys may be due to earlier attacks of scarlet fever.

The diseases here considered constitute an important part of those which are known as contagious. Contagious diseases are those which are transmitted from one person to others by direct or indirect contact. They are

sometimes also designated "communicable diseases."

CAUSES

Each of these diseases is caused by its own peculiar germ. We may compare the germs causing contagious diseases to seeds of plants. Each variety of seed will produce only the sort of plant from which it came. Each of these diseases is due to the implantation of its own peculiar germ in the body, and except in this way the disease never occurs. Each case thus originates from a previous case of the same sort. The old idea that contagious diseases are caused by sewer gas, bad air, disturbances in the weather or similar things, is now known to be untrue. The germs causing diphtheria, scarlet fever and whooping cough and perhaps measles have been isolated and studied. They are all bacteria, which are very small vegetable organisms. In order to be seen by the human eye, they must be magnified about one thousand times by a microscope.

As seeds must be placed in suitable soil if they are to grow and produce plants, so disease germs must find a suitable soil in the body in order to cause disease.

IMMUNITY AND SUSCEPTIBILITY

If disease germs are received by a person whose body acts as barren soil no disease results, while if they reach a person whose body furnishes suitable soil for growth, disease follows. The former person is said to be immune to the disease. The latter is spoken of as susceptible. It is well known that few persons

ever have the same contagious disease twice. One attack renders immune a person who was susceptible. This explains why we have epidemics of contagious diseases. During the epidemic most of the persons in a community who are susceptible contract the disease. At the end of the epidemic most of the suitable soil for the growth of the special germ has been exhausted and the population of the community has become immune to the disease. This causes the epidemic to cease. Another outbreak in the same community of the same disease can only occur when susceptible individuals have again accumulated, i. e., when children have been born and reached a suitable age. Epidemics of contagious diseases are naturally confined largely to children who have grown up after the last epidemic occurred, the older members of the community having been rendered immune by attack of the disease earlier in life. In isolated situations where the germs of contagious diseases are not often introduced persons may reach adult age without ever having been exposed to them. Such adults may then become infected the same as children. In the late world war large numbers of young men from rural communities who had never had the usual contagious diseases were brought together in training camps, and thus furnished fertile soil for many epidemic diseases. In a study of over 30,000 native white children in 14 localities in the United States it was found that at 5 years of age 65% have had measles, 48% whooping cough, 22% chicken pox, 5% scarlet fever, and 3.5% diphtheria.

As age advanced the proportions increased until at 15 years of age, 88% have had measles, 77.6% whooping cough, 51% chicken pox, 11.6% scarlet fever, and 8.7% diphtheria. By young adult age most persons have had these diseases which are often spoken of as children's diseases, but some persons are affected later, some adults at quite advanced age.

HOW NEW CASES ORIGINATE

The germs which cause these diseases are given off and escape from the sick person in various secretions and discharges. This includes discharges from the throat, nose, ears and eyes; pus from abscesses in the neck; sputum or other excretions. The crusts from the skin lesions of chicken pox contain the germs of the disease, but the scales from the skin in measles and scarlet fever do not usually do so. The amount of secretion or discharge required to carry enough germs to cause infection is very minute. When the germs are once located on suitable soil they multiply rapidly and enormous numbers are soon produced from an original few. In originating new cases of disease the secretion from the sick with its germs is deposited on some part of the mucous membrane, or lining of the respiratory tract, as the lining of the nose, throat or larynx; or enters through the mouth, and, being swallowed, lodges in the stomach or intestine. At times the infecting material enters through wounds and injuries of the skin, the intact healthy skin usually forming a perfect protection against infection.

The passage of secretions from the sick per-

son to others is accomplished in numerous ways. Some times this is through direct contact between two persons, as in kissing. More often the contact is indirect, the secretion being carried on some object. Anything that is contaminated by secretions may carry them to a second person. A few of the most common carriers, such as hands, clothing, bedding, eating utensils, cups, forks and spoons, toys and pet animals may be mentioned. During forced expiratory efforts, such as coughing, sneezing, hawking, stuttering, loud talking or crying, small particles of secretions from the throat and mouth are thrown into the air in the form of what is known as mouth spray. This may be inhaled by persons who are near and be deposited in the throat or nose. This manner of transferring contagious diseases is not so frequent as the others mentioned, and only occurs at distances of a few feet. Secretions which become dry and pulverized into dust outside the body soon lose their power of infecting. Dust is not of much danger as a means of transferring contagious diseases. Sometimes various foods which are contaminated by disease discharges serve to carry them to well persons, in which case they may be deposited in the throat or pass into the stomach or intestines. This is specially true of milk, which has been responsible for many outbreaks of scarlet fever and diphtheria. The disease germs in the milk do not come from cows, but get into the milk during or after milking from the hands, sputum and other means of contact of the persons who handle the milk.

CARRIERS

In recent years persons who are known as disease carriers have been looked on as important factors in the spread of many contagious diseases. The part they play in diphtheria has been abundantly demonstrated and is important. Carriers in this sense are persons who are well, but who carry about disease germs in their throats or noses. They may have recently passed through mild attacks of the disease whose germs remain for a long time after recovery, or they may have received the germs from sick persons, never having been sick. This condition of carriage may persist a long time, and carriers are especially dangerous because not usually suspected.

COMMON PECULIARITIES

Some common peculiarities of contagious diseases may be mentioned. After exposure a definite period of incubation passes before any symptoms develop; many of these diseases have characteristic skin eruptions; they occur in epidemics, especially in children, and one attack usually protects the individual during life.

PREVENTION

Because of the wide distribution of contagious disease and the large number of deaths caused by them, attempts to prevent their spread have been made from remote times. This has been largely concerned with isolation or quarantine of sick persons. Doubtless these measures have been useful, but that they have largely failed to accomplish what is ex-

pected of them is not surprising if we bear in mind that many of these diseases are most contagious early in their course before they are recognized and before quarantine is begun, and if we consider the important part which is played by healthy carriers who are not suspected and go about freely.

An ideal condition would obtain if it were possible to render all children, early in life, immune to these diseases. In vaccination against smallpox we have a measure which has banished smallpox to a large extent and which, if universally employed, would eradicate the disease. Similar vaccination measures are now available for diphtheria and scarlet fever. They are easily carried out, devoid of danger, and rarely cause even slight discomfort. These will be again referred to in discussing the individual diseases.

QUARANTINE AND DISINFECTION

The term quarantine was originally applied to the forty days during which a ship suspected of being infected with a contagious disease was held before those on board were allowed to come into contact with those on shore. In present conditions a better term to use is isolation which varies in length and severity in different diseases. The period of isolation in diphtheria is until the person is free of the germs which cause the disease. As it is possible to cultivate and recognize the diphtheria germs the period of isolation can be accurately determined. At times it is only a few days; at other times it must be extended to weeks or even months. In the case of scarlet fever

and diphtheria the attendant who is liable to carry infectious materials is isolated with the patient.

In scarlet fever the isolation is four or five weeks and until all discharges have ceased. Discharges from the nose and ear after scarlet fever are apt to contain the cause of the disease, and so are dangerous. Epidemics of scarlet fever have been started in communities by the coming of a child who still had a running ear following scarlet fever many weeks previously.

The danger of transferring measles is quickly over, and patients may be released after the fever has been absent two or three days.

In chicken pox the separation of all scabs is the measure of the isolation period.

Whooping cough is released when the characteristic paroxyms cease.

If measles or whooping cough appears in a child in a family, other children may be sent from home in hope that they have not been infected. They must not be sent where there are children who may be infected if the disease develops.

In diphtheria and scarlet fever the separation of the sick must be absolute. No communication must be allowed between the sick and well. The patient and attendant should be in a separate building, or in a room which can be shut off from the rest of the house. Nothing should pass from the sick room that is not sterilized at once. All discharges should be collected on pieces of gauze, and these with surgical dressings, portions of food, fruit or

other material which the patient may have handled may be placed in paper bags and burned without opening. All sheets, towels, pillow covers and bed clothes should be boiled in water before being washed. The same disinfection should be used for eating utensils. After recovery the patient and attendant should be given a thorough bath in warm water with soap. The hair also is washed. In a clean room fresh clothing is to be put on. After the isolation room is emptied of its occupants all its contents are disinfected as thoroughly as possible. This can be accomplished by boiling everything which can be treated in this way, by burning things which have little value and which cannot be boiled such as books, toys, mattresses and pillows contaminated by secretions, by thoroughly washing with warm water and soap all wood work, floors and furniture, and by thoroughly airing and sunning the bedding. The fumigation which was formerly generally used has been largely discontinued. Much more can be accomplished by washing, painting, and removal of paper and replacing by new. A safe rule is to burn everything which can not be boiled in water or thoroughly cleansed with warm water and soap. Fresh air and sunshine are most efficient destroyers of germs. Children recently relieved from isolation after diphtheria and especially after scarlet fever should not sleep with well children for a week or two, and should not be kissed.

The disinfection required after measles, whooping cough and chicken pox is limited and consists of thorough airing and sunning.

It is not desirable to confine children with whooping cough. They may be taken out of doors, but must not be allowed to play with well children. Diphtheria carriers may also be allowed to be out of doors provided provision is made for keeping them from well persons. Their eating utensils, toys, etc., must always be treated as are those of persons with active diphtheria.

The closing of schools at the times of outbreaks of the contagious diseases is of doubtful value. It does not prevent contact between the children when at play. Most favorable conditions for dissemination of contagious diseases exist in Sunday schools since children too young to attend school as well as older children are here brought together. If closing of schools is to accomplish any good in controlling contagious diseases it must be combined with separation of the families of children at home, and the prevention of children coming together in picture shows and other places.

It is hardly necessary to state that no child who is acutely sick should be sent to school. So many contagious diseases are impossible of recognition at the beginning that each case of sickness must be considered suspicious until it is shown to be harmless.

MEASLES

Measles is one of the most contagious diseases, ranking in this respect with small pox. It was apparently observed by the earliest medical writers and has been known throughout the world for several hundred years as a common epidemic disease. It is characteristic of measles that it usually occurs in epidemics which vary much in severity, and which appear especially in the spring months. At such times almost every one in a community who has not had measles is affected. After a longer or shorter interval when susceptible persons have again accumulated, a new introduction results in another epidemic. In cities a few cases occur every year and about every two or three years epidemic outbreaks appear. Almost every person is susceptible to measles until he contracts the disease after which there is almost perfect immunity for life. Second attacks are very rare. As high as 98 or 99 per cent of people are originally susceptible. The disease is usually contracted at the first exposure. If persons have escaped in earlier life they may be affected in adult years, even at advanced age. Among people who have never had measles, epidemics may take on alarming proportions. When this disease was introduced into the Faroe Islands in 1846, over 6,000 of the 7,782 inhabitants were attacked. In 1775 measles was introduced into the Sandwich Islands and in four months 40,000 of the

population of 150,000 died. In 1875, measles was carried to the Fiji Islands with the resulting death of one-fifth of the population (20,000). In the late war many young men from rural districts, who had never had measles, were brought together in military camps. When measles gained entrance extensive epidemics resulted. Because of the great contagiousness of measles, and its almost universal susceptibility most persons are attacked early in life. While it is especially a disease of childhood, it rarely occurs in infants below six months of age. By the time 15 years has been reached about 90 per cent of children have had the disease.

Healthy children living in good hygienic surroundings usually pass through measles without much trouble. Delicate, poorly nourished children who live in institutions and in parts of cities where there is overcrowding in unhygienic conditions often do badly and many of them die. This is especially true of young children. As a cause of death among children measles ranks third among the acute contagious diseases. In the registration area of the United States in 1920, there were 7,712 deaths from measles of which 78 per cent were in children under 5 years of age. In Chicago from 1917 to 1921, 718 deaths from measles occurred, over 90 per cent of which were children under 5 years of age. In this country 2 to 3 per cent of children in private families who have measles die, but in institutions and hospitals the deaths may reach 6 to 10 per cent.

Emphasis has been placed on the fact that measles causes many deaths, especially among

young children, in order to draw attention to the fact that young children, especially those not very strong, should be kept away from this disease as long as possible. To willfully expose young children to measles, as is sometimes done, is dangerous and open to the severest criticism.

CAUSE AND MODE OF SPREAD

The germ which causes measles has not been certainly isolated but it is known to be in the secretions from the respiratory mucous membrane. It is there in the earliest stages of the disease, two or three days before the skin eruption appears, and it disappears when the eruption fades. The danger of spreading the disease is therefore present very early, before the eruption develops, and it is soon over, having passed when fever has been absent a couple of days. The germs pass from the sick to others in the secretions from the respiratory tract. In coughing and sneezing small particles of infected mucus are thrown out into the air as mouth spray and the inhalation of these causes infection. Outside the body the germs quickly die. They do not survive drying and exposure to the sunlight. Transfer of the disease by a third person or by any mechanical carrier can only occur if it is done quickly. The particles of moist secretion which convey the infection may be very small and may be carried several feet in the air. Thus a susceptible individual may be infected by coming into a room with a case of measles although never approaching very close. Similarly a child coming down with measles

while in school may sow the germs widely among other pupils.

SYMPTOMS

The symptoms may be considered as they occur in three stages; catarrhal, eruptive and convalescent. After infection no signs of illness appear for several days. This is the period of incubation. About eight to ten days after exposure, very fine, pin-point size spots appear on the lining of the cheek opposite the molar teeth. These are known as Koplik spots. They are bluish-white in color and seen only by bright daylight. About the same time catarrhal symptoms appear, such as a little fever, coryza, sneezing, hoarse cough, watery eyes. The symptoms as they occur in this catarrhal stage of measles are usually supposed to be due to a cold. After a further three, four or five days, i. e.—12 to 13 days after exposure—the typical eruption appears. It is first seen over the forehead at the border of the hair, behind the ears and on the neck. This gradually spreads during two or three days over the face, body and finally the arms and legs. The eruption occurs as small red spots or blotches, round or oval in form. They tend to become larger and finally run together, so that at the height of the eruption the skin of the face and body is completely covered, only small islands of pale skin appearing. The color of the eruption is deeper red than that of scarlet fever, and is much coarser. During the time the eruption is coming out the fever is often high and the catarrhal symptoms are marked. Light hurts the eyes, and they become bleary red, the secretions causing the lids to stick

together during sleep. The cough is often very troublesome. At first it is dry and later looser. There is often hoarseness and sometimes the patient can talk only in a whisper. When the eruption has reached its height it soon begins to fade, but traces often remain for a week or more. As the eruption begins to fade the fever falls, often very rapidly. A fine branny scaling of the skin follows the fading of the eruption.

COMPLICATIONS

The danger from measles depends almost entirely on its complications. In any case if fever persists after the rash fades and the patient does not rapidly improve complications must be suspected. Sometimes a looseness of the bowels occurs with the onset of measles, but it usually stops as the eruption comes out. In babies the intestinal disturbance may continue and grow worse as the disease progresses. This may become a grave complication in young children. Most often dangerous complications have to do with the respiratory tract. In small children there is a special tendency for the inflammation to extend from the bronchial tubes to the lungs with resulting pneumonia, which is the most common cause of death. Sometimes the inflammation extends to the covering of the lungs producing pleurisy. This may become purulent, and then is known as empyema. In this condition pus collects in the chest between the lung and the chest wall, causing compression of the lung. When the pleurisy begins there is pain in the side, but as the pus accumulates this stops. With the collection of pus in the side breathing is interfered with and in children especially the

side affected may be seen to be enlarged and to move less than the other side when the patient breathes. This condition is associated with fever and sweats, and not frequently has aroused suspicion of consumption.

Inflammation inside the ear is a frequent complication of measles. The involvement of the ear follows the passage of infectious material from the throat through the Eustachian tube. There is first fever and pain in the ear, which may subside, or after a day or two, a discharge from the ear appears. The discharge at first is watery and may be tinged with blood, but it soon becomes thick and purulent. With the appearance of discharge the pain subsides and the fever disappears. As healing takes place the discharge again becomes thinner and finally stops. Sometimes the inflammation extends from the ear to the bone back of the ear and mastoid disease results. This is recognized by tenderness on pressing on the bone. When this develops fever returns and the child appears sicker. With mastoid disease there is always danger of extension of the inflammation through the bone and the production of meningitis. Children with measles often have small whitish ulcers in the mouth, on the lining of the cheek, along the gums and on the edges and tip of the tongue. These are apt to be sensitive, causing pain when eating, and associated with profuse flow of saliva. Very rarely these ulcers become black and there results an extensive ulceration of the entire face. This occurs only in poorly nourished children, especially in institutions.

Measles has the property of rendering the patient susceptible to other contagious diseases. Tuberculosis often progresses rapidly after measles. This should always be suspected if fever and cough continue after the rash fades. If diphtheria is contracted during or soon after measles it runs a particularly virulent course. On the other hand when measles follows other contagious diseases, especially whooping cough, it is more fatal. Children with whooping cough should be kept away from measles with special care.

PREVENTION

Prevention of measles is difficult because the most contagious period is that which precedes the eruption. At this time the child is usually supposed to have a cold and mixes freely with other children. To prevent the further spread, each patient must be isolated until fever has been absent two or three days. Children who have not had measles may be allowed to go about freely for a week after exposure, and then should be isolated until 15 days after exposure. Fortunately we are now able to prevent measles in young children even after exposure. This is accomplished by drawing a little blood from one who has recently recovered from the disease and injecting it into the exposed one. This usually prevents the disease entirely or at any rate renders it mild if it occurs. Blood drawn from a parent and injected into the child soon after exposure renders the disease mild. The drawing of the required amount of blood is devoid of any danger.

TREATMENT

Each person with measles should be put to bed and kept there until free of fever. Care must be taken to avoid exposure to drafts. Fluids are to be given freely, including cold water. Tepid baths should be given and add much to the comfort of the patient. If the fever is high it may often be lowered by frequent sponging with tepid water. Even quite warm water is grateful and the temperature of the bath may be determined by the feelings of the patient. When pain in the ear occurs it may often be relieved by applying heat, either wet or dry as most grateful. The pain is often relieved and the congestion reduced by putting in the ear a few drops of warm glycerine to which 5 to 10 per cent of carbolic acid has been added. When there is a discharge from the ear, the secretion must not be allowed to accumulate. The canal may be gently washed with warm boric acid solution, using no force, and then dried with little swabs of absorbent cotton. The canal must not be plugged with cotton, but the discharge allowed to drain freely. If the discharge is profuse a pad of gauze over the ear may be used to absorb it. Persistent discharge or tenderness about the ear demands attention by someone specially qualified.

The room should be moderately darkened to relieve the eyes. The eyes should be bathed with warm boric acid solution and sticking of the eye lids may be prevented by the application to the edges, especially before sleep, of a little vaseline. The diet at first may be largely milk, but general diet may be given as the ap-

petite returns. In young children any intestinal disturbance should receive the attention of a doctor. The mouth should be kept clean by washing with boric acid solution or other mild washes. If there has been hoarseness in a child with measles and it tends to increase, especially if there are any croupy symptoms, a doctor should be consulted at once. Such cases are sometimes diphtheria of the larynx, engrafted upon measles.

At the termination of measles the measures for disinfection consist especially of thorough airing and sunning of room and contents.

DIPHTHERIA

Of all the contagious diseases diphtheria is most thoroughly understood. The cause is known, its method of spread understood, and the way in which it acts to bring about the disease has been clearly demonstrated. For its prevention and cure we have certain measures. In spite of this it continues to be one of the most dreaded and fatal diseases of children. Diphtheria is an ancient disease and has appeared in destructive epidemics in Europe and America for two hundred years. It caused the death of George Washington, and the empress Josephine and her grand-child, heir apparent to the French throne, died from it. As early as 1771 it was epidemic in New York and in 1856 an epidemic in San Francisco occurred in which few children attacked by it recovered. Before antitoxin came into use in 1894, of those attacked, one-third to one-quarter died, and in hospitals often 60 to 80 per cent of the cases terminated in death. After antitoxin came into use many more recovered, but for some years now little improvement in the prevalence and fatality from diphtheria has occurred. In Chicago from 1911 to 1920, there was an annual average of 7,358 cases and 813 deaths from diphtheria. Of those dying, 63 per cent were children below school age, and 90 per cent were children less than 10 years of age.

CAUSE AND HOW IT ACTS

The cause of diphtheria, discovered in 1883-84 by Klebs and Loeffler, two German scientists, is the diphtheria bacillus. It is a minute rod shaped vegetable organism sometimes spoken of as a germ. If it is taken into the throat and lodges and grows upon the tonsils two results may follow. If the person is susceptible diphtheria occurs. If the person is immune no local changes occur and the individual becomes a carrier. Both may transfer the germs to other persons. We may compare what occurs here to what happens when persons come in contact with certain higher plants. The poison ivy vine has in its leaves a specific poison which causes an inflammation of the skin of some persons who are susceptible to it, but has no effect upon others who are immune. So the diphtheria plant as it grows in the throat produces soluble poisons or toxins which causes the changes we call diphtheria in a susceptible person, but is without effect on the immune person. The immune person is protected by an antidote or antitoxin which is in the blood, while the susceptible person has none. After the diphtheria bacilli have localized on the tonsil the events which follow may be briefly stated. In their growth the bacilli produce poisons and as a result the tonsils become red and swollen. On the surface of the tonsil, where the injury is greatest, white spots appear, and, as they enlarge, they run together to form the membrane which is characteristic of the disease. The name diphtheria means in its derivation a

pellicle or skin. This membrane often extends beyond the tonsils, spreading over the throat, up to the roof of the mouth, over the palate. Sometimes it goes from the throat upward into the back of the nose or downward into the larynx. Wherever the membrane spreads the tissues below are swollen. In the nose the nostrils become occluded and the patient cannot breath through the nose; in the throat the tonsils become very large interfering with swallowing and breathing. In the larynx the swelling causes hoarseness, croupy cough, and finally difficulty in breathing which may terminate in death from strangulation unless relieved. This is what was formerly called membranous croup. The membrane in the throat is first white, but as it thickens it becomes grayish-yellow, like buck skin, and finally may be black. It is closely adherent and not readily wiped off. When the disease extends to the larynx it tends to go further along the windpipe until it reaches the lungs with resulting pneumonia. When the changes in the throat are severe, there is external swelling of the neck. This may be extreme and is sometimes mistaken for mumps.

While the things we have spoken of are going on poisons are being taken by the blood to all parts of the body. In this way they reach and injure the muscle of the heart, and this injury is of such a degree in severe cases that it causes death. The poisons in the blood also profoundly injure the nervous system with resulting paralysis, so that the eyes are turned to the side, swallowing becomes difficult or

impossible, and the muscles of the body and limbs become weak. These paralyses appear as late as six to eight weeks after the beginning of the disease. The symptoms as described are as they occur at the present time in cases untreated by antitoxin. Some cases are mild and never reach an extreme degree. In some the laryngeal symptoms develop early and death from obstruction to breathing may occur before much is seen in the throat. Sometimes a child who has what appears as a tonsilitis for several days shows a sudden extension to the larnyx. The onset of diphtheria is insidious. The child acts "dopey", has a little fever, and does not usually complain of pain in the throat. A child with acute tonsilitis is at first apparently much sicker, has more fever and complains more of soreness in the throat.

RECOGNITION OF DIPHTHERIA

Many cases of diphtheria may be recognized with considerable certainty by the appearance of the membrane in the throat, but there is only one way by which diphtheria of all degrees can be certainly recognized especially at the onset; that is by the detection of the germ. The making of cultures for diphtheria bacilli by a doctor is easily performed, and the materials for such cultures and their examination are provided for by local and state health laboratories. It would be desirable to have cultures made from every sore throat at the beginning. In this way much valuable time would be gained and many lives saved by the early use of antitoxin.

HOW DIPHTHERIA IS SPREAD

The general discussion of the ways in which contagious diseases are spread at the beginning of this article covers also diphtheria. The germs are in the secretions from the throat and nose. About one person out of every ten who is about a case of diphtheria becomes a carrier. Carriers play a large part in the spread of this disease. When an outbreak occurs in a school, it can usually be traced to one or more healthy carriers among the pupils or even the teachers. This is determined by making cultures from all the throats and noses. Diphtheria may be introduced into a community by a carrier who comes from outside.

TREATMENT

The sovereign remedy for diphtheria is antitoxin. If given early and in sufficient amount practically every case could be cured. Diphtheria antitoxin was first used in Berlin in 1891. It came into general use about 1894. Like most new remedies it met much opposition at first but is now recognized throughout the civilized world as the one essential means of cure. Cases given antitoxin on the first day practically always recover, only a little over 1 per cent die. Each day of delay is shown in the results. When given the second day, a little over 3 per cent die; the third day, over 6 per cent die; the fourth day, nearly 11 per cent, the fifth day, 15 per cent. In hospitals where many cases come late under treatment,

about 10 per cent of the cases of diphtheria now die. This is in marked contrast to the 50 to 80 per cent of deaths in preantitoxin days. The patients who receive antitoxin early not only have greater chance of recovery but they get well promptly after a very brief illness, while those that come late under treatment, even if they recover, do so after a tedious illness and protracted period of convalescence.

The important things in treating diphtheria with antitoxin are early administration and sufficient amounts. The earlier given the smaller the dose required. The doctor from experience is able to estimate the dose needed in each case. A moderate dose is 5 to 10 thousand units, a full dose is from 20 to 30 thousand units. A small fire may be extinguished by a little water, but when it has spread much more is needed. The damage done by the diphtheria poisons before antitoxin is given cannot be undone by any amount of antitoxin. Antitoxin only prevents further injury. If sufficient injury to the heart and kidneys has occurred death will follow. Lost time cannot be regained. The antitoxin must be injected with a hypodermic needle. It cannot be given by mouth as it is destroyed and rendered useless in the stomach.

A few hours after enough antitoxin to control the disease has been given marked improvement occurs. The restlessness subsides, the swelling begins to grow less and the membrane separates at the edges and begins to peel off, the color reappears in the pasty cheeks, the pale lips become red again, and the child

which has been blue and struggling for breath falls into quiet sleep. The change in a short time is one of the most remarkable observed in sick persons.

Local treatment is of little value. We no longer gargle, spray and swab the throat. We only try to keep the mouth and throat as clean as we can with cleansing washes but this is not done with the idea of influencing the disease.

If the obstruction to breathing from diphtheria in the larynx becomes extreme this must be relieved by making an opening in the windpipe or by passing a small rigid tube into the larynx through the mouth.

If antitoxin has been given late the complications which have developed must receive appropriate treatment. The duration of confinement to bed will depend on the time antitoxin was given. If given early the patient may be up in a few days. Serious damage to the heart and kidneys may require confinement to bed for several weeks. When there are heart disturbances perfect quiet in a horizontal position is imperative. Even rising to a sitting position or moderate exertion may be quickly fatal. Such accidents are most apt to occur about the 5th to the 14th day. Recovery from the paralysis is usually complete, but may require several weeks or months. These paralyses may continue to extend for two months, and during this time the weakened muscles must not be used. If unable to swallow the patient must be fed with a rubber tube through the nose or mouth.

PREVENTION OF DIPHTHERIA

Efforts to prevent diphtheria take two main directions. In one the object is to prevent the infection of new persons; in the other the measures employed are used to render well persons immune to the disease so that they will not become sick even if the germs reach them. Prevention of the infection of other persons is accomplished by isolation or quarantine of the sick individual and his attendant. To be effective quarantine must be carried out with conscientious attention to the smallest details. When a member of a family develops diphtheria, other members of the household may permanently leave the house if they are free of diphtheria germs as shown by cultures. The way in which quarantine is carried on has been described as it relates to all the diseases under discussion. In the case of diphtheria quarantine can only be terminated when repeated cultures from the throat and nose have shown that the diphtheria bacilli have disappeared. This may require several weeks and in exceptional cases even months. Carriers must be placed in quarantine as well as active cases. As recovery from diphtheria progresses the germs tend to die out and often are no longer present after a few days. Sometimes the germs persist and the patient becomes a persistent carrier. In the persistent carrier usually some abnormal condition in the nose and throat interferes with the efforts of nature to destroy the germs. When such are corrected the germs often quickly disappear. Most often diseased

adenoids and tonsils are the offending conditions. In this case the removal of abnormal adenoids and tonsils is usually followed by prompt disappearance of the germs. Persistence of bacilli in the nose of children has sometimes been dependent on the presence of foreign bodies such as shoe buttons.

Aside from the measures outlined which have for their purpose the prevention of extension of the germs to other persons, important steps may be taken to render persons immune to diphtheria so that they will not be affected by the germs. This is accomplished in two ways. In the presence of immediate danger, small doses of antitoxin at intervals of three to four weeks procure protection. This is to be selected when children in a family cannot be protected from infection by quarantine. When immediate danger is absent an immunity which lasts for years may be secured by a sort of vaccination. This consists of three hypodermic injections at intervals of a week of a mixture of diphtheria toxin and antitoxin. The amount injected is very small and produces little or no inconvenience, but it is followed in a few weeks by a lasting protection against future infections. Almost all persons become immune after such injections. Such vaccinations have been used in a large scale among school children in New York City. Among 90,000 school children thus treated only one-fourth as many cases of diphtheria occurred last year as among the same number who refused the treatment. Injections are advised in children as early as possible after six months of age is reached. If

this were uniformly employed children would be protected against diphtheria during the most susceptible years, and the disease would largely disappear. It is not too much to hope that this vaccination measure against this most fatal disease of children will accomplish corresponding favorable results to those which have followed vaccination against small pox.

It is not desirable or necessary to use such injections in children who are already immune. By a simple harmless test it is possible to determine if susceptibility exists in the individual. This is known as the Schick test. It is easily given and is devoid of all danger and discomfort. Such tests have shown that the proportion of persons susceptible to diphtheria varies with age. Few infants under six months are susceptible. From one to three years about 60 per cent are susceptible. As age advances the proportion gradually decreases so that by 20 years only about 20 per cent are liable to be infected if opportunity occurs. The children in the families of the well-to-do are susceptible in larger proportions than are those living in crowded parts of cities, and in country districts the proportion of susceptible children is very high.

BAD EFFECTS OF SERUM

Antitoxin is contained in the blood serum of horses, which have been injected with diphtheria toxins, and cannot be entirely separated from other parts of the serum. The antitoxin itself probably produces no disturbances, but the serum sometimes causes hives and other

inconveniences which quickly pass away. Probably no person with diphtheria has been permanently harmed by antitoxin. A few instances of death have followed the use of small immunizing doses in persons who were not sick and were subject to "horse asthma". Such cases can be counted on the fingers of the hands and appear insignificant when contrasted with the hundreds of thousands of injections given during the same time. Diphtheria in one week causes five to ten times as many deaths as antitoxin serum in thirty years. In our large cities as many children are killed daily by motor vehicles as have died from antitoxin serum in thirty years. In the presence of the enormous danger from diphtheria, we can ignore the infinitesimal danger from the serum.

SUGGESTIONS OF MEASURES CALCULATED TO ELIMINATE DIPHTHERIA AND ITS DANGERS

1. Teaching children to have their throats examined when they are well, and the examination of the throat whenever a child is not well.

2. Call a doctor immediately when a child has a sore throat, swelling of the neck, or any croupy condition with hoarseness.

3. Taking cultures at the first visit of the doctor.

4. Giving antitoxin at once whenever there is any exudate in the throat or any condition resembling diphtheria.

5. Protection of children with antitoxin when they are intimately associated with others who have diphtheria.

6. Immunization of all children over six months of age with toxin-antitoxin.

7. Pasteurization or heating of all milk used by children.

SCARLET FEVER

Quite accurate descriptions of scarlet fever have existed for over three hundred years. One of the best of the early descriptions was written by William Douglass, a doctor in Boston, at the time when the first epidemic of this disease on this continent occurred in 1735-1736. From the Atlantic Coast the disease gradually extended westward and ever since has appeared at intervals in all parts of this country, following the settlers into the new regions and often causing many deaths among their children. A very striking peculiarity of scarlet fever is the great variation in virulence at different times. Sometimes it is so mild that scarcely any deaths are associated with it; at other times it takes on such a high degree of virulence that it wipes out whole families of children. In cities isolated cases are always present, and at intervals of a few years epidemic outbreaks occur. For many years in this country scarlet fever has gradually become less severe and while the total cases of the disease have not been much reduced, deaths have become much fewer. In recent years the proportion of deaths in scarlet fever has varied from 1.5 to 10 per cent. The death rate is highest in infancy and decreases with advancing age. Few cases of scarlet fever occur in children under one year of age, the largest number is observed in children up to 10 years. The disease is not so infrequent in young

adults, and occasional instances appear in persons of quite advanced age. In these respects it resembles diphtheria. The disease is most prevalent in late autumn and winter.

CAUSE

The cause of scarlet fever is a small round bacterium known as the streptococcus of scarlet fever. This germ is in the secretion from the throat, and nose, in discharges from the ears, in pus from abscess in the neck and in the discharges from infected wounds. The germ is very tenacious of life. In dried secretions it may remain alive for a long time. Instances are known where clothing, worn by children when sick with the disease, has been put away in a dark place. When this clothing was brought out many years later and given healthy children to wear they contracted scarlet fever.

MODE OF SPREADING

The germs of the disease pass from the sick person to others in particles of the secretions already mentioned. This transfer is usually accomplished by direct contact or by the agency of some carrier such as infected hands, eating utensils, toys, etc. In the manner of its dissemination scarlet fever resembles diphtheria very closely. This disease does not often pass from one person to another through the air as occurs in measles. Like diphtheria it is sometimes spread through milk which has been handled by someone who has recently had the disease or has been in close contact with

t. Many epidemics of scarlet fever have been traced to contaminated milk. Usually the germs first lodge in the throat, often on the tonsils. Sometimes they enter through wounds.

EFFECTS OF THE INFECTION

The results of the location of the germs in the throat or in wounds depend on whether the individual is susceptible or immune. One attack of scarlet fever is followed by immunity which usually lasts through life. A second attack is very rare. Many persons probably are immune because they have sometime passed through very mild forms of the disease which were not recognized as scarlet fever at all. If the germs have secured a footing in a susceptible person they grow and produce their poisons or toxines. These cause inflammation of the tonsils, and other parts of the throat and as the toxines enter the blood and are carried to all parts of the body they cause fever, an eruption of the skin, and injury to various organs, especially the heart and kidneys.

SYMPTOMS

The period of incubation, i.e., the time between exposure or infection and the appearance of signs of illness—is very short in scarlet fever. It may be only a day or two and is almost always less than a week. The onset is very sudden. A child goes to school as usual in the morning and during the day becomes acutely sick, or he goes to bed at night in apparent health and by morning is virulently ill.

At the beginning there is fever, which may quickly rise very high, sore throat and often vomiting. The throat is so sore that the patient usually complains very much of it, and acute pain is caused by swallowing. Vomiting once or several times in the early part of the disease is very common. Whenever a child is suddenly taken with fever, a sore throat and vomiting, scarlet fever should be suspected. Soon the eruption appears. This usually is present within 24 hours, but may de delayed 2 or 3 days in rare instances. It is first seen upon the neck and chest, rapidly extends to the body, then to the arms and legs. It is absent on the face. The skin about the mouth is paler than natural. The rash consists of very small red points closely set upon the skin which shows a uniform bright red flush. The skin looks much like that seen after severe sunburn. The color is bright scarlet. If one looks at the throat it is bright red, and often small white spots are seen upon the swollen tonsils. The tongue is coated white through which bright red points may project giving the appearance spoken of as "strawberry tongue." At the sides of the neck the glands are swollen and tender. In size they may correspond to a marble, or may attain the size of a hen's egg or larger. While the eruption is coming out, the throat remains very sore, and the fever is high. Especially at night, children in this acute stage of scarlet fever are apt to show delirium and may try to get out of bed. After two to four days the fever begins to fall, the throat becomes less sore, and the rash fades.

As the rash fades the skin is roughened and peels in small flakes. About three weeks from the onset the thick skin of the palms of the hands and soles of the feet peels off. The detached pieces may be large, or only small delicate pieces may come from the fingers and toes. This late peeling is very characteristic. The case to which the preceding description applies is one of average severity. Many mild cases have little fever and slight rashes which last but a few hours. The sore throat is constant even in mild cases.

COMPLICATIONS

Complications of scarlet fever are common and it is in these that most of the danger lies. In the throat ulcers may form on the tonsils and elsewhere resulting in extensive destruction of tissues. Secondary to such conditions the glands in the neck may become swollen and may break down with resulting abscesses. The inflammation in the throat may extend to the nose and nasal sinuses with associated purulent discharge from the nostrils. Extension of the inflammation from the throat along the Eustachian tubes to the middle ear is frequent, and occurs most often when the illness has lasted a week or so. Many times this causes only transient pain, but often there develops a discharge of purulent material from the external ear. Sometimes the destruction within the ear is so severe and extensive that deafness results. Scarlet fever is responsible for a considerable number of instances of acquired deaf-mutism. Inflammation in the ear

is indicated by pain which may be severe. After a few hours or sometimes only after days perforation of the drumhead is followed by a discharge from the ear. At first this is watery, sometimes tinged with blood, and soon becomes thick and purulent. With healing it again becomes thinner and finally stops. Most of such ears, after recovery have the hearing but little dulled. Fever is apt to recur or become higher when the trouble in the ear starts, and when perforation occurs the pain stops and the fever falls. Mastoid disease may be caused by extension of the inflammation from the ear to the bone behind the ear. This is recognized by pain, tenderness and swelling back of the ear. This is always dangerous.

It is quite common for patients with scarlet fever to have joint pains about 4 to 10 days after being taken sick. A few or many joints are involved, and as the pain disappears from one joint it appears in another. After a few days this disturbance comes to an end without leaving any permanent damage. The poisons of scarlet fever circulating in the blood, sometimes cause severe and even fatal damage to the heart. Injury to the kidneys is common with resulting acute Bright's disease. This develops early or late in scarlet fever. The late cases, which come after the child has been sick for about three weeks, are most characteristic. Attention is often directed to this condition by a high colored, smoky urine, and by a puffy swelling of the eyelids. Later the swelling, due to the accumulation of water, becomes more extensive and general dropsy may result.

With the dropsy and scanty, highly-colored urine, there may be associated disturbances of sight, headaches, vomiting and convulsions. Under appropriate treatment recovery from nephritis usually occurs, but in a few instances death results. While usually the heart and kidneys apparently return to normal after recovery from scarlet fever, there is much evidence which indicates that heart and kidney diseases later in life may be dependent upon damage done during this disease.

PREVENTION OF SCARLET FEVER

Effort to prevent scarlet fever may take two directions; the first is directed toward limiting the spread from the sick individual and consist of isolation and disinfection; the second concerns itself with the production of immunity in susceptible children. Similar to the Schick test in diphtheria, we have the Dick test in scarlet fever. If a very small quantity of the toxins of scarlet fever is injected into the skin of a person the result will vary according to whether the person is susceptible or immune to the disease. In the susceptible person a redness of the skin appears where the injection was made, while in the immune person this does not occur. In this way it is possible to pick out the children who will not contract scarlet fever if exposed. Those who give a positive reaction with the Dick test, i.e.—show a redness of the skin at the point of injection of the toxin—may be rendered immune by a process of vaccination. This consists of three injections at intervals of a week of small

quantities of scarlet fever toxins or poisons. Little or no disturbance follows the administration of suitable amounts of the toxins, but usually an immunity results. There is every reason to believe that the immunity produced in this manner will be permanent as is that which follows an attack of the disease.

Children who have been exposed to scarlet fever should be kept away from other children for 10 days after the last exposure. To prevent spread of the disease the sick child must be isolated and this must be continued for four or five weeks, and in every case until all discharges from the nose and ears have stopped. The throat must also have become normal before the child is released. Removal of the tonsils does not appear to render children less susceptible to scarlet fever, but diseased tonsils when scarlet fever occurs add to the gravity of the case by favoring severe throat and nasal complications and especially extension to the ear. The details of isolation and terminal disinfection are discussed in detail in connection with their use in these diseases as a group.

Proper pasteurization of milk will prevent the spread of scarlet fever through this common food of children.

TREATMENT

The patient should be kept in bed for three weeks and chilling of the skin prevented. This is important in even the mildest cases in order to avoid kidney complications.

Skillful management and careful nursing

does much good in scarlet fever. In the acute stage when fever is high much relief is afforded by baths. Small children may be placed in a bath of warm water and left there for 15 to 20 minutes. The temperature of the water must not be below that which is comfortable to the child, but it may be gradually lowered by adding cold water. While in the bath the head should be kept cool with wet cloths. The bath lowers the fever, quiets the nervous symptoms and favors sleep. In older children and adults the same results may be secured by sponging the body and by packing in wet sheets. In any case the temperature of the water used should be adapted to the sensibility of the patient. He should not be chilled, and quite warm water is often most grateful and followed by the most beneficial results.

Throughout the disease liberal amounts of water should be taken. This is given cold. In young children this can be accomplished by giving small quantities at frequent intervals. Water increases the elimination of the poisons, and its administration is one of the most important measures in the management of the disease. If the stomach is disturbed with a tendency to vomit cold water, small amounts of weak tea, taken as hot as possible, will sometimes help settle the stomach.

The diet during the early period will be principally milk. As the fever falls and the appetite returns cereals, toast, fruits and vegetables may be added. Eggs and meats are best withheld until three weeks from the onset. In septic cases with prolonged course, liberal feed-

ing with easily digested foods is of the greatest importance. The mouth and throat should be kept as clean as possible. In persons who are large enough frequent use of bland gargles are desirable. For this purpose a tablespoonful of table salt or baking soda to a pint of water is suitable. Rubber bags filled loosely with finely cracked ice and applied to the neck, relieve the soreness of the throat. They are specially useful when the neck is swollen, and tend to prevent the formation of abscesses in the glands of the neck.

Pain in the ear is treated by the application of heat. A few drops of warm glycerine, to which carbolic acid in the proportion of five to ten per cent is added when dropped into the ear is very useful in relieving pain and reducing inflammation. When a discharge from the ear occurs, it must be collected on gauze which is burned. The canal must be kept as clean as possible and secretion not allowed to accumulate. If it is thick and does not run out freely the ear may be gently washed out with a saturated solution of boric acid in water. The ear must not be plugged with cotton but drainage must be facilitated. As the discharge becomes less the ear should be cleansed with boric acid dissolved in alcohol and then dried carefully with small pledgets of absorbent cotton.

Pain and tenderness back of the ear always calls for expert advice. Such cases often come to operation which must not be too long deferred if results are to be satisfactory. Also when signs of kidney disease appear, such as

swelling of the eyelids, vomiting, etc., medical advice should be sought as quickly as possible.

The painful joints which occur in some cases are usually relieved by hot applications.

Until recently the treatment of scarlet fever has been entirely symptomatic, and directed toward conserving the strength of the child and toward preventing complications until nature cured the disease. Natural recovery occurs when the individual who is sick makes his own antidote for the poisons of the disease. We may assist nature by injecting into the acutely sick person, some blood drawn from an individual recently recovered from the disease. The convalescent blood, containing the antidote or antitoxin, serves to destroy the poison in the blood of the acutely sick child, and so aids recovery. Marked improvement often follows the use of convalescent serum. Such serum is not always at hand, but if an older child or adult who has had scarlet fever is available, his blood may be drawn and injected into the sick child. There is reason to believe that we may soon have a scarlet fever antitoxin, produced from horses in a manner similar to that in use in making antitoxin for diphtheria.

The successful treatment of scarlet fever with its many complications demands great skill. There is no disease in which the outcome depends more on judicious medical management and careful persistent nursing than in scarlet fever.

CHICKEN POX

Corresponding to measles in its degree of contagiousness, chicken pox occurs in extensive epidemics. In cities occasional cases appear at any time, but at intervals epidemic outbreaks occur. Most children have the disease during early years, but adults may also have it if they have not come in contact with it in childhood. This disease is entirely different from small pox and has no relationship to chickens. The cause is unknown, but doubtless is a living germ. The crusts from the skin have usually been blamed for the transferring of the disease from one person to others. The disease however is contagious before the crusts from the body have separated, and it is likely that the infectious agent may be in the respiratory secretions early in the disease. One attack protects for life. Second attacks are practically unknown.

The period of incubation which passes between the time of exposure and the appearance of signs of the disease is quite long, being about three weeks, varying in individuals between twelve and twenty-two days.

SYMPTOMS

As in all of these contagious diseases there is much variation in the severity of the individual case. Most cases of chicken pox are mild affairs. There is no fever or general dis-

turbance, only the eruption of a mild or moderate sort. In a few individuals the disease assumes a severe form, in which case, fever, headache, backache and chilliness precede the eruption for a day. This is especially apt to occur in adults, but children may have some fever, and be generally unwell for a day or so before the eruption appears. Preceding the characteristic eruption there sometimes appears a day or so earlier a redness of the skin which has often been looked upon as scarlet fever until the typical eruption has developed.

The individual lesions of the chicken pox eruption pass through an evolution which is often very rapid. There is first a pink blotch or spot which soon is a little elevated above the skin, and disappears when pressed upon. Soon this is replaced by a vesicle or water blister. The vesicles are very near the surface of the skin and have a very thin covering, so that they often look like drops of water lying on the skin. The covering is soon broken, the fluid escapes, and as drying occurs a little crust or scab is left. This separates after several days. There is great variation in the number of these lesions. Sometimes only two or three develop. In severe cases the lesions are very closely placed on the body so that the finger can hardly be placed at any point between them. In the average case the lesions lie two or three inches apart. The distribution upon the body is quite characteristic. Most lesions are located on the parts of the body covered by clothing. In mild and moderate

cases the eruption is almost confined to the trunk, but some lesions are also seen upon the arms, legs and forehead. In severe cases rather abundant eruption appears on the face, arms and legs. The lesions develop in the scalp, palms of the hands and soles of the feet in limited numbers especially in more severe cases. In such instances also, vesicles appear in the mucous membrane of the mouth, especially on the palate, and as they rupture they leave very sensitive points which are painful when food is taken.

One of the most characteristic things of the chicken pox eruption is that the lesions appear in crops. By the time the first lesions have reached the crusting stage others are present which are still vesicles, and still younger ones appear as pink spots. New lesions continue to appear for 3 or 4 days. In parts of the body where the skin is thick as on the palms of the hands, soles of the feet and forehead, the vesicles may remain unruptured for some time in which case the contents becomes yellowish and the surrounding skin reddened. If the skin has been rendered specially susceptible by an cause, the eruption is apt to be more severe. When chicken pox follows upon scarlet fever the eruption is apt to be profuse. Upon parts of the body which have been recently burned by the sun or subject to irritation under a surgical dressing, cast, or diaper, the eruption is more abundant than on other portions of the body.

COMPLICATIONS

There are few deaths following chicken pox

and many of these cannot be properly blamed on the disease. There occur occasionally in poorly nourished children, gangrenous processes in the skin which may cause death. Blood poisoning may rarely follow the introduction of ordinary wound infections into the open lesions. The itching associated with the drying stage is very troublesome, and children sometimes in scratching, break the deeper layers of the skin, and small ulcers are produced which heal with scars or pits. One most often sees these scars on the forehead of children. Usually no permanent pits follow recovery.

DIFFERENT FROM SMALL POX

In the presence of small pox in a community its differentiation from some cases of chicken pox is important but sometimes difficult. One of the most striking differences between the two diseases is that in chicken pox the lesions occur in crops, all the stages of the eruption being present at the same time, while in small pox the lesions are all the same sort at any time. Another difference consists in the distribution of the eruption, in chicken pox most is on the covered parts of the body while in small pox the eruption is most abundant on the exposed parts of the skin, the face, wrists and hands. The presence of a fairly recent vaccination scar is always strong evidence against small pox.

PREVENTION

The only means of prevention is the isola-

tion of the sick person until all the scabs have separated.

TREATMENT

Little treatment is required. Scratching of the skin is to be avoided. During the acute stage it is best to keep the skin dry. When the crusts have become dry baths may be given, and they probably hasten the separation of the scabs.

WHOOPING COUGH

Whooping cough is a very contagious disease which is contracted by most children during early years. Occasional persons who have escaped it in childhood are affected in adult life. Second attacks are rare. Sometimes a mother or nurse, who has had whooping cough in childhood, will again contract the disease when caring for children who are suffering from it. In distinction to most of the contagious diseases, whooping cough frequently occurs in infants less than a year of age, and the mortality associated with it is due largely to this fact. In Chicago from 1911 to 1922, out of 39,233 cases of whooping cough 1,630 were fatal. This represents one death out of every 24 patients, and corresponds very closely to the death rate in scarlet fever during the same period and is about three times as high as that in measles. Of 97 deaths from whooping cough in Chicago during 1922, 58 were in children under 1 year of age, and all but one were in children under 5 years. This serves to emphasize the importance of protecting young children from the disease as long as possible.

The cause of whooping cough appears to be a very minute bacillus which is found in the secretions from the upper respiratory tract. The action of this germ seems to be through poisons which it produces. The disease is transferred from one person to others through small

particles of the secretions which are thrown out into the air during coughing. These moist particles being inhaled, gain a lodgement in the throat and thus cause another case. The time after exposure before symptoms appear is indefinite. Exact dates are hard to fix, but the incubation period is often very short. It may vary from five to fifteen days.

SYMPTOMS

The onset of whooping cough is gradual and for some time the child is usually supposed to be suffering from a cold or bronchitis. This first or catarrhal stage has nothing which is characteristic. There is a cough which gradually increases in severity. As the cough becomes more severe it assumes also more of a paroxysmal character with a tendency to recur at certain intervals. After about two weeks with the appearance of typical paroxysms the second or paroxysmal stage is entered upon. This lasts about six weeks on an average. The number of paroxysms varies greatly. There may be but one or two in 24 hours, or one may occur every hour. On an average about 10 to 15 are observed during 24 hours. They are apt to be most severe at night. When a paroxysm of coughing begins the child sits up and if old enough tries to get hold of something for support. The paroxysms consists of a series of expiratory coughs following in such rapid succession that the child is unable to get its breath. These have been compared to the explosions of a motor cycle, or those of a machine gun. At the height of a severe paroxysm the face is red or

blue as in choking, saliva flows from the mouth, the tongue protrudes and is blue, the child struggles for breath, when finally, maybe only after several seconds, the spasm relaxes somewhat and air is drawn through the narrowed opening in the larynx with a peculiar crowing sound which is known as the whoop and has given the name of the disease. Such a series of events often is repeated several times in quick succession. Finally the end comes with vomiting which not only gets rid of the mucus in the throat but also empties the mucus from the air tubes. The child now falls down on the bed exhausted, the skin wet with sweat and it often falls to sleep. The struggle of the little patient in its efforts to get its breath cannot fail to awaken the sympathy of anyone who witnesses it. In older children the paroxysms are better borne and the general strength is not much affected. In young children with frequent paroxysms and loss of food from vomiting much depression and weakness develops. When there are frequent severe seizures the face in the intervals has a woe-begone expression, the skin is dusky and the eyes dull.

COMPLICATIONS

Occasionally a child dies in a severe paroxysms from strangulation. Most deaths are, however, dependent upon complications. Of these the most frequent is pneumonia, which is not uncommon in infants. Convulsions also cause many deaths. They may occur during the paroxysms of coughing and if repeated are

very dangerous. The great congestion of the blood vessels of the head during the paroxysms sometimes leads to rupture of blood vessels, so, that nose-bleed is not infrequent. Hemorrhage into the brain may occur. Bleeding beneath the conjunctiva of the eye-ball results in red blotches over the white of the eye. These may be small or the blood may spread over the entire white portion of the eye-ball causing a most striking appearance. Bleeding into the loose tissues of the eye-lid may occur, producing a "black eye". This has been mistaken as due to injury and should be remembered as something which may occur spontaneously during whooping cough.

In infants disturbances of digestion are frequent, and intestinal disorders in them are grave and add materially to the danger of the disease.

After recovery permanent damage to the heart may remain. The condition brought about by the disease also favors the rapid progress of any tubercular disease which otherwise might be of little moment.

PREVENTION

It is important that small children be kept away from this disease as long as possible. It is particularly difficult to limit the spread of the disease by isolation because the period of greatest contagiousness is that in the beginning when the child is supposed to have a cold. An older child in a family contracts the disease at school or in play with other children,

and before he is suspected of having the disease, the younger members of the family have been infected. A vaccine has been prepared from the bacillus of whooping cough which appears to have some value in preventing and rendering milder the disease. As this is harmless it ought to be given to young children as soon after exposure as possible in the hope that it may prevent the disease or make it milder if it develops. After the paroxysms have been established the vaccine seems to be less useful.

TREATMENT

Many cases, especially in older healthy children, require little treatment. When paroxysms are frequent and severe, remedies to reduce them are desirable, and of these paregoric seems to do as well as any. If vomiting occurs frequently the loss of food is of importance. In such cases easily digested food should be given as soon after a paroxysm as possible so as to allow time for digestion and absorption before another paroxysm occurs. The feeding is of great importance in infants. A simple mechanical appliance is of considerable use to these children. It consists of a firm binder fastened snugly about the entire abdomen. It should come up over the lower ribs, and be held in place by straps over the shoulders. This gives support to the abdomen during coughing, enables the child to endure the paroxysms easier, and also supports the weaker points of the abdominal wall and so prevents the development of hernias or ruptures. Of all measures used

in the treatment of whooping cough the most important is the furnishing of fresh air. In suitable weather the children should be kept out of doors all day, and at night should have plenty of fresh air. This is equally the case when pneumonia complicates whooping cough.

Other Little Blue Books

Biography

5 Life of Samuel Johnson. Macaulay.
393 Life of Frederick the Great. Macaulay.
33 Brann: Smasher of Shams. Gunn.
312 Life and Works of Laurence Sterne. Gunn.
429 Life and Works of Jonathan Swift. Gunn.
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